OPERATING INSTRUCTIONS

Direct Reading Resistance
Bridge
Model T.1098

H. W. Sullivan Limited

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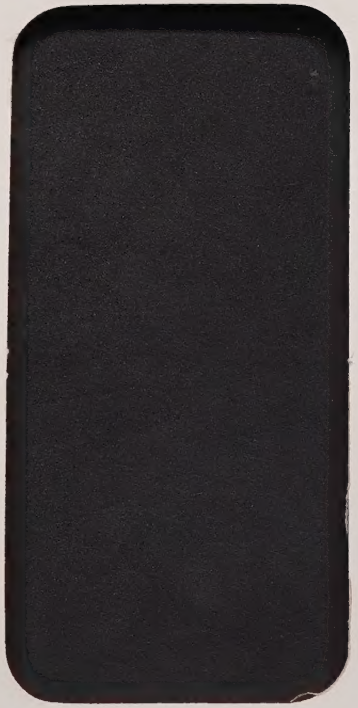
Orpington BR5 3QU
Kent

A Member of the Electrical Products Division of George Kent Limited



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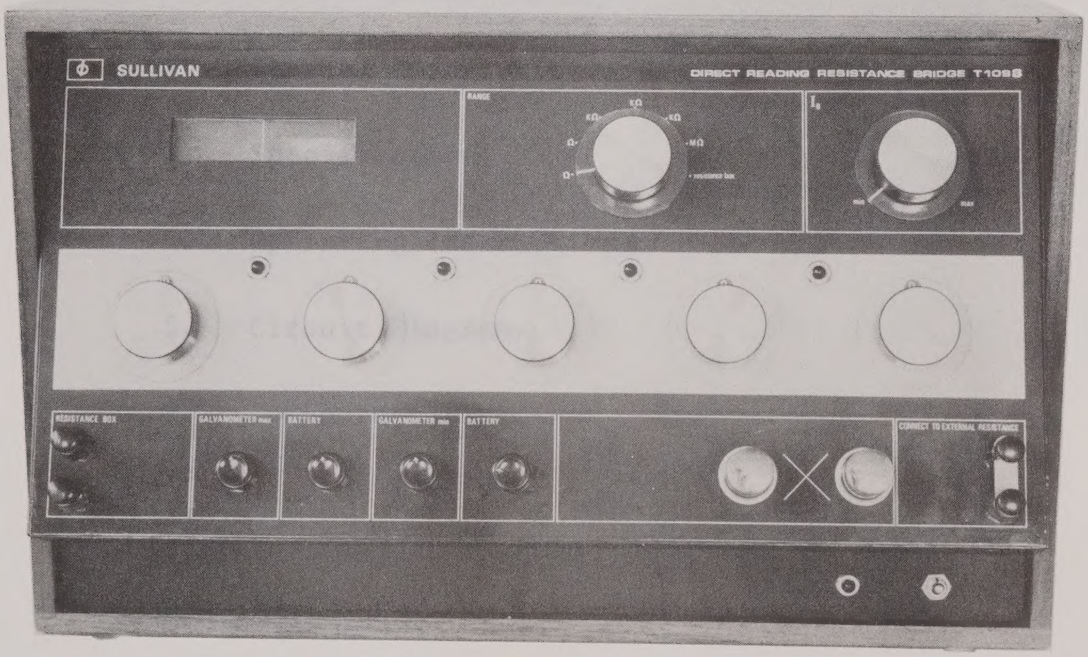

Photograph of the Instrument

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2.0. GENERAL DESCRIPTION.

The T.1098 is a self-contained resistance bridge which operates from a standard a.c. mains supply. Integral with the bridge is a rectified d.c. supply which can be controlled to suit the resistance being measured, and a sensitive spot galvanometer.

Two galvanometer keys are provided; the one marked "min." enables the user to search for balance with reduced sensitivity, the other marked "max." introduces full sensitivity.

The supply to the bridge may be reversed by the battery key marked "f" and "r".

The instrument is a five decade Wheatstone Bridge, covering from 1 m ohm to 10 M ohm in six ranges.

The measured value is presented as an " in line " read-out with an illuminated decimal point displayed at the relevant position for each range.

Separate terminals marked "Resistance Box" enable the "known arm" of the bridge to be used as a five decade resistance box of 11,111 ohms in steps of 0.1 ohm.

Provision is made for insertion of resistance to counter-balance residuals and thus correctly measure incremental resistance. These terminals are marked "Connect to external Resistance" and unless in use, must be joined by the link provided.

The instrument is housed in a waxed teak-finished box, with the panel at a convenient angle for ease of operation.

3.0. SPECIFICATION.

3.1. Range of measurement

Range switch position (Reading clockwise)	Practical measuring range ohms	Discrimination ohms
1st Ω	1 - 100	0.001
2nd Ω	100 - 1K	0.01
1st K Ω	1K - 10K	0.1
2nd K Ω	10K - 100K	1
3rd K Ω	100K - 1M	10
M Ω	1M - 10M	100

3.2. Accuracy

± 0.05% over the range 10 ohm - 10 M ohm. The use of an external resistance to compensate for residual resistance realises this accuracy down to 1 ohm, the required discrimination at this level being obtained by galvanometer deflection interpolation.

3.3. Resistance Box.

When used as a five decade resistance box the accuracy levels are as tabulated.

Decade	Accuracy
10 x 1 K ohm	± 0.03%
10 x 100 ohm	± 0.03%
10 x 10 ohm	± 0.05%
10 x 1 ohm	± 0.1%
10 x 0.1 ohm	± 0.001 ohm

4.0. OPERATING INSTRUCTIONS.

4.1. Setting up the bridge

4.1.1.

When the instrument is received, the galvanometer will be protected by a short-circuiting link. Remove the back panel by releasing four captive coin slot screws, and cut the link as indicated by a label. Replace the back panel before introducing the mains plug.

4.1.2.

Set the voltage selector at the rear of the instrument to the appropriate position, and insert the mains supply plug. A switch and an indicator lamp are located at the right lower corner of the front panel.

4.1.3.

Observe that the illuminated spot is visible on the galvanometer scale and adjust if necessary to the zero position by means of the lever at the left side of the case.

4.1.4.

To familiarise the user with the bridge it is suggested that a short circuit is applied to the "X" terminals, and the controls operated until a null is obtained. (Zero deflection of the galvanometer spot.)

4.1.5.

The battery and galvanometer keys are designed to be tapped to give momentary contact when exploring for balance or locked in the "make" position by turning clockwise.

4.1.6.

It is usual when measuring resistors of low reactance to lock the galvanometer key and tap the battery key.

4.1.7.

For the purpose of this preliminary exercise, set the I_B control at approximately mid-position and the battery reversing switch to "f". With the galvanometer "min." key locked, tap the left hand battery key. Irrespective of where the range switch or the decades are set, (except in the unlikely circumstances that the balance conditions have been preset), the spot will deflect. Since the short-circuited "X" terminals must produce a measured value of virtually zero, the direction of deflection is that which indicates a reduction in the range and/or the "known arm" setting.

It is convenient to so arrange the direction that the spot moving to the right requires a reduction in the decade setting to restore balance. If this is not so when the battery polarity switch is at "f", use the position "r".

4.1.8.

The final balance setting for the test suggested will be range switch at 1st Ω , and the decades at 0 - 0 - 0 - 0 - 2; this is a measure of the internal residual resistance. It will be found that when measuring such a low resistance and in order to obtain sufficient discrimination, it will be necessary to use the key "Galvanometer max." quite early in the sequence of operations, and may be necessary to increase the I_B control to "max."

4.1.9.

The pair of terminals marked "connect to external resistance" are normally linked, but where a significant amount of lead resistance or box residual resistance is involved, the link may be replaced by a variable resistor preferably one with 0.01 ohm steps.

Set to the required range, and set the decades all to zero.

With the testing leads joined together, balance the bridge using the external variable resistor only. The setting of this resistor must remain untouched during all tests on a given range, but must be rebalanced for a change of range, since it is affected by the range factor in the same way as the "known arm" of the bridge.

4.2.

The purpose of the battery reversing key is to enable the user to eliminate the effects of thermal e.m.f.'s, or of polarization, in the resistor being measured. A balance is indicated when reversing the supply causes no change in the galvanometer deflection.

4.2.1.

When measuring resistors with a significant reactive component, it is expedient to lock the battery key and tap the galvanometer key.

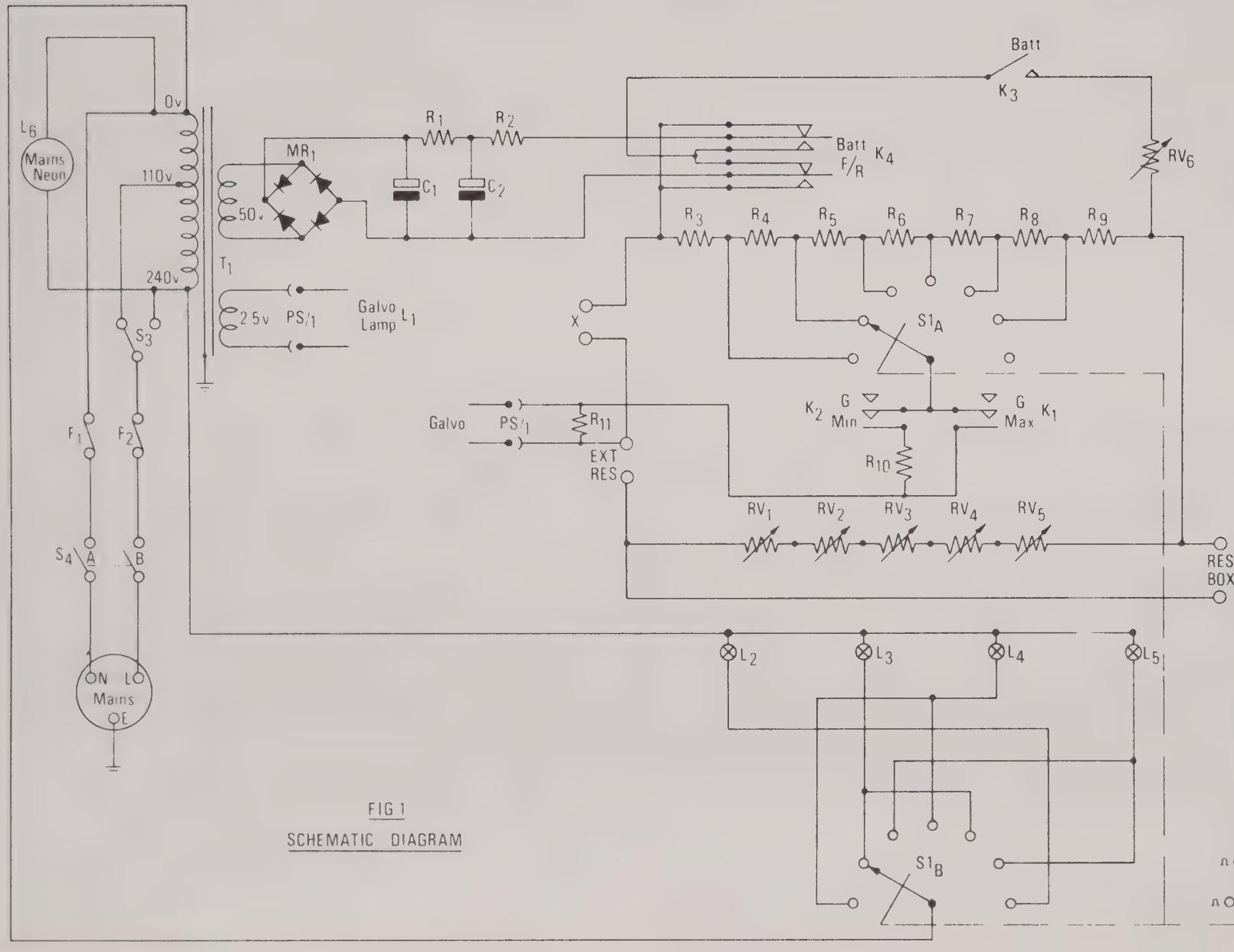

FIG 1

SCHEMATIC DIAGRAM

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6.0. COMPONENTS LIST.

Circuit Reference	Value	Part No.
R1 - R2	1 K ohm ± 2% 1.5w	26633-1073
R3	43.564 ohms HWS	4000 21708
R4	356.44 ohms HWS	4000 21077
R5	1.8 K ohms HWS	4000 21076
R6	1.8 K ohms HWS	4000 21076
R7	356.44 ohms HWS	4000 21077
R8	39.168 ohms HWS	4000 21079
R9	4.3956 ohms HWS	4000 21080
R10	100 K ohms ± 5% ½w	26632-3621
R11	500 ohms HWS	E.D.R. Coil
RV1	10 x 0.1 ohms HWS	4000 21089
RV2	10 x 1 ohm HWS	4000 20267
RV3	10 x 10 ohms HWS	4000 20265
RV4	10 x 100 ohms HWS	4000 20263
RV5	10 x 1 K ohm HWS	4000 20261

6.1.

C1	50 µF)	
C2	50 µF)- 20% + 50%) 150V D.C.	26224 2502

6.2.

F1	250 mA	28236 4449
F2	250 mA	28236 4449

6.3	Description	
K1	Galvo. Max. HWS	4000 20066
K2	Galvo. Min. HWS	4000 20066
K3	Batt. Key HWS	4000 20066
K4	Batt. Key F/R HWS	4000 20066

6.4.

S1 S1/A S1/B	Range Change Switch HWS	4000 21075

6.5.

Circuit Reference	Description	Part No.
L1	Lamp 2.5V, 0.2 Amp MES	27811 6313
L2 - L6	Neon Lamp	27826 7517

6.6

MR1	4 Rectifiers	27612-5119

6.7

RV6	Rheostat 20KΩ ± 10% 2w	26836 4235.

ADDENDUM

GALVANOMETER LAMP

To replace the Galvanometer lamp it will be necessary to carry out the following procedure.

Withdraw the Mains plug and remove the back cover by turning the four coin slot screws.

This will provide access to the rear half of the lamp telescope which will be seen at the top right hand side of the instrument.

Remove the telescope section by gently twisting and pulling the knurled portion.

The lamp is set deeply in the housing to prevent stray light reaching the scale and it may be difficult to remove unless the fingers are quite dry. Alternatively, one may prefer to use a bulb remover.

If it is possible, choose a replacement bulb with a centrally placed filament, and with the minimum of moulding marks on the top of the glass since these produce distortion of the image.

Replace the telescope with its new lamp screwed firmly home, and before replacing the back of the instrument rotate the tube and push in to the position of optimum focus. Continue to twist the tube to and fro until the position of maximum brightness and clarity is reached. It will be found that the position of optimum focus does not necessarily produce a clean image without exploring with this twisting motion.

Vertical adjustment of the spot is provided for by using the screwdriver slot adjustment below the lamp housing.

Finally, assemble the back cover in position, having made quite certain that none of the exposed resistive elements or the switch contact surfaces have been handled.

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